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ABSTRACT

A naturalistic study of 21 college students (at Carnegie Mellon University in Pennsylvania) writing research papers provides detailed analyses of the roles that notetaking, planning, goal-setting, and revising play in students' approaches and examines whether these "high investment" reading and writing processes lead to higher quality papers. Findings suggest that in order to help students use reading and writing as tools for critical inquiry, teachers need to structure research paper assignments in particular ways and to help students to examine and revise their interpretations of common academic writing assignments such as the research paper. (Three tables of data are included; 36 references are attached.) (Author/SG)

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CENTER FOR THE STUDY OF WRITING

Technical Report No. 59

CONSTRUCTING A RESEARCH PAPER: A STUDY OF STUDENTS' GOALS AND APPROACHES

Jennie Nelson

February, 1992

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Abstract

This naturalistic study of 21 college students writing research papers provides detailed analyses of the roles that notetaking, planning, goal-setting, and revising play in students' approaches and examines whether these "high-investment" reading and writing processes lead to higher quality papers. The researcher suggests that in order to help students to use reading and writing as tools for critical inquiry, teachers need to structure research paper assignments in particular ways and to help students to examine and revise their interpretations of common academic writing assignments like the research paper.

CONSTRUCTING A RESEARCH PAPER: A STUDY OF STUDENTS' GOALS AND APPROACHES

Jennie Nelson
Arizona State University

"Writing a long essay is probably the most complex constructive act that most human beings are ever expected to perform" (Bereiter & Scardamalia, 1983, p. 20). Writing a research paper—one of the most common college-level writing tasks (Bridgeman & Carlson, 1985)—is a particularly demanding constructive act. A writer must locate, read, select, and organize material from different sources to form an original synthesis. However, case studies of students writing research papers reveal that some writers manage to simplify this complex task in ingenious ways.

This is how Clare, a bright college senior, described how she went about sizing up an assignment for a history course. After conducting some preliminary library research on her assigned topic, she came up with two possible paths for completing her research paper. She explained that the "easier" path involved skipping any notetaking or written plans and composing her paper directly at the computer by summarizing her sources and "just shoving in quotes" because "they support themselves." Then she would "tack on some sort of analysis in the last paragraph," clean up any surface errors by running "spell-checker," and "round the paper out to ten pages by using a twelve point font."

In contrast, the more difficult path Clare described involved extended research and the careful analysis of what she called the "voices" or conflicting points of view about her topic. She explained that this analysis would lead to original conclusions about the "truths" behind her sources' accounts and would require careful planning, multiple drafts, and revision. While this paper would be "more fun" to write, she explained that the "easier topic" would take less time away from her other courses and would probably earn her a relatively high grade (Nelson & Hayes, 1988 p. 6).

Researchers have found that the paths students choose to complete writing assignments can lead to very different learning outcomes (Langer & Applebee, 1987; Penrose, 1988). The "easier" path Clare described would allow her to produce a ten page paper fairly quickly, without engaging in any substantive planning, drafting, or revision—all writing strategies that are stressed in process-centered writing instruction (Applebee, 1986). Moreover, these shortcuts and her over-reliance on direct quotations to summarize sources may have an impact on what she learns from this writing assignment. In their recent study of the role that writing plays in shaping learning, Langer and Applebee (1987) found that the more content is manipulated through writing, the more likely it is to be understood and remembered. By skipping notetaking and essentially copying from source texts, Clare would limit the manipulation of her source material to a very superficial level. Clearly, the choice this student makes between these two paths could mean the difference between a worthwhile learning and writing experience and an unchallenging exercise in reproducing information.

Unfortunately, as teachers often we are not aware of the paths and processes our students choose to complete such common academic writing assignments as the research paper. Do students responding to a typical college writing assignment often rely on truncated writing processes like those described by Clare above? The results of controlled studies of high school and college students suggest that, for the most part, student writers do not engage in much planning, drafting, or revising (Bridwell, 1980; Perl, 1980; Pianko, 1979; Sommers, 1978; Stallard, 1974). Furthermore, some researchers have found that

when students do revise extensively, the quality of their writing may not improve (Beach, 1976; Bridwell, 1980; Perl, 1979). Based on these findings, researchers have argued that students may need to be taught how to engage in the kinds of planning and revising activities that are the hallmark of more experienced writers. However, Clare's sophisticated analysis of the different paths available for producing a research paper reveals the conditional nature of composing processes. Studies in which students are asked to write short papers under laboratory conditions may not provide a clear picture of the true role of planning, drafting, and revising in students' composing processes.

As Clare points out, these processes are time-consuming and demanding. We need to know whether students working under natural conditions over extended periods of time rely on these more time-consuming processes and whether the investment pays off. Do these high-investment writing processes lead to higher quality papers? If so, what can teachers do to foster the use of these processes? The following study was designed to answer these questions.

METHOD

Setting and Task

This study was conducted in a large introductory cognitive psychology class at Carnegie Mellon University. Since all entering freshmen (some 300 students) were required to take this course, it provided a useful forum for studying students' natural approaches to research writing tasks. Students in the course were required to attend lectures given by the professor and were also assigned to one of 13 discussion sections. Eight teaching assistants were responsible for conducting discussions, and administering and grading quizzes and writing assignments.

The students enrolled in each section were required to write a 5-8 page research paper on one of 20 assigned topics. They were given 4 weeks to complete their projects. A written description of the assignment included the following guidelines: "The purpose of this paper is to enrich your knowledge of psychology by encouraging you to explore a psychological topic in-depth. Your audience should be other undergraduate students who do not know your topic. Your paper should present an integrated point of view; it should be integrated around a purpose; it should not be a book review or an unrelated list of facts." In addition to these general guidelines, students also received a list of criteria for grading which included "knowledge of subject matter, understanding of basic concepts, organization, critical thinking, and clarity for an undergraduate audience." While students in all 13 sections of the class received the same general assignment guidelines, students in half (6 of 13) of the sections were also required to fulfill certain process requirements while completing their papers.

Participants

To be able to compare papers written on the same topic across different classroom settings, I selected 6 topics from the assigned list of 20 topics as the focus of my research. These 6 topics—identified with the professor's help—ranged from general (i.e. instinctive behavior) to more specific (i.e. language in primates other than man). Students were asked to take part in the study on the basis of the topic they selected for their paper. To ensure that approximately the same number of students (4-5) wrote on each topic, students were chosen sequentially; for example, students in section one of the course who had chosen topics 1 and 2 were selected, students in section two who had chosen topics 3 and 4 were selected, and students in section three who had chosen topics 5 and 6 were selected. This pattern for selecting participants was repeated across all 13 sections; thus 26 students

initially agreed to take part, two students from each of the 13 sections who had selected one of the 6 topics.

Procedures for Data Collection

As a researcher from the English department, independent of the cognitive psychology course, I approached the 26 students individually and asked them to participate in the study. I explained that my goal for conducting the study was to learn more about how students completed the many tasks involved in writing research papers and stressed that I was interested in their natural way of doing things. All of the students I approached agreed to take part, and, because of the long term commitment the study required, they were paid for completing the project.

The 26 participants were asked to keep a daily log of their research and writing activities for the research paper. Log entries had to be delivered on a regular schedule, at least three times a week, even if the student had not worked on the paper during that time. Students understood that their goal was to explain in as much detail as possible how their papers evolved from beginning to end. Their log entries could include information about the research trail they followed in the library, how they evaluated a prospective source, how they took notes and organized material, any discussions they had with other people, how much time they spent on paper-related activities, and how they actually composed the paper. In addition, students provided copies of all their notes, outlines, and drafts as they were produced.[1]

Shortly after the midterm, three of the participants withdrew from the course and could no longer take part in the study. In addition, two students withdrew from the study for personal reasons. Thus 21 students actually completed the study and provided process logs and copies of all their work.

Procedures for Data Analysis

Students' process logs and written work were analyzed on three levels. First, to characterize how students approach research paper tasks in actual classroom settings, several measures were developed to capture different aspects of students' composing processes. Specifically, measures were created to examine the kinds of goals or concerns students raised when working on their research paper projects, the kinds of plans (in the form of notes and structural plans) students produced, whether students wrote multiple drafts and made substantive revisions between drafts, and, generally, how much time and effort students devoted to their tasks. Second, in order to determine whether these various process measures were related to the quality of students' finished papers, correlations between paper quality and composing processes were examined. And, third, I examined whether students required to complete different process requirements in certain classrooms differed in their approaches.

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[1]While retrospective reports such as those gathered in process logs can provide valuable insights about the goals and processes of writers working over extended periods of time, the validity of such reports cannot be determined in any definitive way (See Ericsson & Simon, 1980; Morris, 1981; Tomlinson, 1984). However, the findings of other researchers (Faigley, Cherry, Jolliffe, Skinner, 1985; Nelson & Hayes, 1988; Sternglass & Pugh, 1986) reveal the benefits of using writing logs as a research tool for examining the concerns and approaches of writers working in natural settings on extended writing tasks.

The data analysis included 7 measures for students' processes as revealed in their logs, notes, and drafts and a single holistic quality measure for their finished papers.[2] The process measures included: 1) time on task; 2) evidence of revision between drafts; 3) extensiveness of notes; 4) evidence of processing of source material in notes; 5) elaborateness of written plans; 6) goals described in log entries; 7) focus of the goals described in log entries. For these measures reliability was computed with Pearson's product moment correlations unless indicated otherwise. Inter-rater reliability for two independent raters using the process measures ranged from .99 to .96.

Holistic quality. The research papers were judged for overall quality (Cooper & Odell, 1977) by four independent raters, all experienced writing teachers. Each rater sorted the 21 papers from high to low by placing them in four roughly equal groups. Papers in the lowest group received a score of 1, papers in the next lowest and next highest groups received scores of 2 and 3, and papers in the highest group received a score of 4. Inter-rater reliability among the four raters, calculated using Cronbach's Alpha, was .88. The four raters' scores for each paper were combined to arrive at a summed holistic quality score for each paper. These summed scores, ranging from a possible low of 4 to a possible high of 16, were used in later analyses.

Time on task. Time on task, as evidenced in students' logs and written work, was measured by sorting students' logs and placing them in four roughly equal groups from high to low. Two independent raters read students' accounts of how they completed their assignments and compared students' notes, plans, and drafts to determine how much time students invested in their research paper projects.

Revision between drafts. All of the 21 students' handwritten or typed drafts were examined by two raters to determine whether students had made any substantive changes between the first drafts and final versions of their papers. Students were given credit for revising only if they made changes between first and final versions at a global versus local level. This meant that only those papers which showed changes in larger linguistic units such as sentences, paragraphs, or larger chunks of text, received credit for revisions; substitutions of one word for another did not count as revising (Bridwell, 1980).

Extensiveness of notes. Extensiveness of notes was measured with a four-level scale: 0=no notes (underlined photocopies of source materials did not count as notes); 1=very scant notes (normally only a page or two), or notes that included large passages of copied prose and few discrete facts or pieces of information; 2=moderately extensive notes containing a fair amount of information from sources; 3=very extensive notes containing a great deal of source information.

Evidence of processing of source material in notes. This measure was designed to examine how much students manipulated or processed source material in taking notes. Bretzing and Kulhavy (1979) argue that students' notes can be seen as "a reflection of how deeply material is being processed" (pp. 147-48). In the current study, evidence of depth of processing in students' written notes was determined using a four-level scale. Since students writing research papers typically rely on multiple sources, a scale was developed to measure processing *within* individual sources and *among* or *across* several

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[2]There are obvious tradeoffs in using self-reports and textual evidence to examine students' composing processes. Planning and revision can involve the development of structures and changes in mental representations as well as in written texts (Witte, 1987). The measures used in this study cannot capture these elusive mental representations. Although retrospective reports and written texts may not provide as full a picture of writers' decision-making processes as on-line procedures such as think aloud protocols, they are less disruptive and allow researchers to study writers working over extended periods of time.

sources. Two independent raters used the following scale to rate students' notes: 0=no notes; 1=notes consist mostly of direct quotations or large passages of lifted prose with little evidence of paraphrasing, summarizing, or subordination of source material; 2=notes mostly consist of pithy summaries or lists of information from sources; 3=notes include evidence of processing within sources (i.e., summaries, outlines, subordination, labeling) and include evidence of processing across or among sources.

Elaborateness of written plans. This measure was designed to examine the nature of students' written plans for their papers. These plans included outlines or lists of main topics or sections. The following four-level scale was used to examine how much students' written plans represented a whole text, including main points or sections, and supporting points or examples: 0=no written plans; 1=scant plans in the form of bare, unelaborated outlines or lists of main points or sections; 2=plans which are fairly extensive but are very general with little specific information embedded; 3=plans which are quite elaborate and include main ideas or sections and some embedding of supporting points or examples.

Goals described in log entries. Two independent raters carefully reviewed each student's log and marked places where the student seemed concerned about the *quality* of the paper he/she was writing, the sources he/she was using, or the material he/she was drawing from. Thus, each student log received a total score for the number of log goals identified by the raters.

Focus of log goals. Researchers who have examined how writers interpret and create plans and goals for completing writing tasks have found that writers differ in the kinds of plans and goals they develop. Carey, Flower, Hayes, Schriver and Haas (1987) found that writers developed plans and goals for dealing with the topic or content, theme, form, and audience of their papers. In order to examine the focus of students' goals or concerns in the current study, two raters categorized log goals using the same system developed by Carey et al. (1987). Raters categorized log goals according to whether they focused on (1) content, (2) form of presentation, (3) audience, (4) theme or focus, or (5) other kinds of concerns.[3]

RESULTS AND DISCUSSION

This study began with several questions: What roles do planning, revising, and goal-setting play in students' approaches to extended writing assignments like the research paper? Do students enrolled in college classes engage in extensive notetaking and planning and produce multiple drafts? Do these "high-investment" writing processes lead to higher quality papers? Can teachers encourage students to take the high-investment path by structuring writing situations in particular ways?

The Roles of Planning, Revising, and Goal-setting in Students' Approaches to the Research Paper Task

The research paper task requires students to select and organize information from multiple sources to create their own texts. Notetaking can be used to select and accumulate information that may be used in later writing. As Table 1 reveals, a third of the students skipped notetaking altogether, while 53 percent of the students produced fairly extensive notes and 14 percent took scant notes. Students' notetaking techniques varied considerably. Some students wrote brief lists of information, while others wrote fluent

[3]For a complete description of the directions raters received for rating students' notes and plans and for identifying and categorizing the goals in students' logs, see Nelson (1988).

prose. Some used outlines to organize material, while others used notecards. Over half of the students who took notes (9 of 14) produced notes which showed a high-level of processing or manipulation of source material. Previous studies of the role of writing in learning (Bretzing & Kulhavy, 1979; Langer & Applebee, 1987) suggest that the more content is manipulated in writing, the more likely it is to be understood and remembered. Taking notes is one way that students can interact with and manipulate information in sources. Of course, without some measure of the learning outcomes for this study, it is difficult to speculate about the influence of notetaking on these students' learning. The results of this naturalistic study of students' notetaking processes suggest that students often do rely on notetaking to help them to select and organize information from multiple sources. In addition, if notes reflect how deeply source material is being processed, it appears that in some cases students process source material at a deep level in their notes.

Table 1
Roles of Planning and Revising in Students' Research Papers

	n of students	percent
Planning		
Extensiveness of Notes		
-no notes	7	.33
-scant notes	3	.14
-extensive notes	11	.53
Level of Processing in Notes		
-no notes	7	.33
-largely verbatim notes	5	.24
-notes with processing within sources	6	.29
-notes with processing across sources	3	.14
Elaborateness of Written Plans		
-no plans	8	.38
-written plans in some form	13	.62
-fairly elaborate whole-text plans	9	.43
Drafting and Revision		
-papers with substantive revisions between drafts	8	.38
-no substantive revision between drafts	13	.62

The results for elaborateness of written plans described in Table 1 reveal that 62 percent of the students produced whole-text plans of some kind for their papers, while 38 percent produced no written plans. Of the 13 students who created whole-text plans, 9 created plans which were judged to be moderately to highly elaborate. These findings, when combined with those of other researchers (Brown, Day & Jones, 1983; Spivey & King, 1989), provide a more complex picture of students' planning abilities. Contrary to

the findings of controlled studies of students' planning abilities (Burtis, Bereiter, Scardamalia, & Tetroe, 1983; Flower & Hayes, 1981; Perl, 1979; Pianko, 1979), these findings suggest that students working under natural conditions may often rely on whole-text planning for certain tasks when the quantity and complexity of information to be included in papers makes such strategies worthwhile.

Finally, as revealed in Table 1, drafting and revising did not appear to play very important roles in students' approaches. Only 8 of the 21 students produced multiple drafts and made substantive revisions between drafts. These findings are similar to those in Butler-Nalin's (1984) naturalistic study of high school students' revising practices. In her study, only 40 percent of the papers contained revisions of any kind, while in the current study of college students only 38 percent of the papers contained revisions beyond the local level. Later in this discussion we will explore why some students produced multiple drafts and whether drafting and revising led to improved final papers.

In addition to examining the roles of planning and revising in students' approaches, it is interesting to examine the kinds of goals students brought to their research paper assignment. Table 2 reveals that students raised the most concerns about the Content, Form, and Theme or focus of their papers. Even though the written instructions students received for their assignment made explicit references to the audience, students raised few concerns about the audience in their logs (only 10 out of 116 log goals concerned the audience for papers). Instead, students revealed in their log entries that they were most concerned about selecting and organizing information from their sources and connecting this material in their papers.This preoccupation with the content, structure, and focus of their papers is not surprising, given the special demands of discourse synthesis tasks like the research paper (Spivey, 1984).

Table 2
Focus of Log Goals

	n of goals (116)	percent
Content	34	.29
Form	34	.29
Audience	10	.09
Theme	28	.24
Other	10	.09

Relationships Between Paper Quality and Composing Processes

Pearson product moment correlations were used to examine general relationships among the product and process measures. The matrix of intercorrelations in Table 3 suggests that several process features are positively correlated with paper quality. The three planning measures—extensiveness of notes ($r = .46$, $p < .025$), level of processing in notes ($r = .54$, $p < .01$), and elaborateness of written plans ($r = .59$, $p < .005$)—are all significantly correlated with essay quality. Not surprisingly, time devoted to the task, which is highly correlated with 5 of the 6 process measures, is the single measure most highly correlated with essay quality ($r = .69$, $p < .0005$). Apparently, the more time students invested in their research paper projects, the more they engaged in process

activities that led to higher quality papers.[4] These findings add to those of other researchers (Brown, Day & Jones, 1983; Kennedy, 1985; Spivey & King, 1989) who also found that planning and time devoted to the task were significantly related to the quality of students' written products on tasks that involve writing from sources.

Table 3
Intercorrelations Among the Product and Process Measures

	2	3	4	5	6	7
1. Holistic Quality	.46	.54	.59	.69	-.12	.34
2. Notes-extensiveness		.94	.55	.81	-.07	.50
3. Notes-processing			.55	.82	-.08	.57
4. Plans-elaborateness				.74	.11	.33
5. Time on task					.13	.62
6. Revision						.18
7. Log Goals						

Note: In the matrix, correlations of about .36, .50, .54, and .66 are significant at the .05, .01, .005, and .0005 levels respectively.

Students' Approaches in Different Classroom Settings

In 7 of the thirteen sections of the cognitive psychology course, students were simply assigned a paper topic and a due date and, in some cases, were given a list of references for paper topics to guide their initial searches for sources. In the remaining 6 sections, assignments included process requirements which forced students to get started early on their research projects. Specifically, students enrolled in 3 sections were required to turn in drafts of their papers two weeks before the final papers were due, and students in 3 sections were required to give a brief in-class oral presentation on their topic up to two weeks before their papers were due. An analysis of students' approaches in these different classroom writing situations revealed that all of the students (5) who had to turn in preliminary drafts made substantive changes between drafts and 60 percent (3 out of 5) of the students required to give oral presentations engaged in substantive revision. Using a

[4]Since paper quality could also be related to other variables besides the process measures, two other analyses were conducted. Pearson product moment correlations between the holistic paper quality measure and student's individual SAT-verbal scores revealed that these measures were not significantly related (r = .240). In addition, an analysis of variance revealed that papers written on the six different topics did not differ significantly in their holistic quality ratings, F (5, 15) = .827. While this suggests that the quality ratings for students' papers were not influenced by the paper topic, these findings may be due to the small sample size (only 21 subjects in all).

Newman-Kuels test, the revising practices of students required to meet these specific process requirements were found to be significantly different from students' practices in the 7 less structured classroom writing situations at the .001 and .01 levels respectively.

But did the revisions students made between drafts and final papers lead to better quality final products? In order to answer this important question, two independent raters compared the drafts and final papers of the 8 students who did revise. The results of this analysis revealed that 6 of the 8 students who revised improved the overall quality of their papers. Four of the final drafts were judged to be considerably better than the first drafts, and two final drafts were judged to be slightly better. The judges rated one pair of papers the same in quality and ranked the draft slightly better than the final paper in one pair of papers. These results suggest that, in most cases, writing more than one draft and making substantive changes between drafts led to better quality final papers.

Students did not receive any feedback from their teachers on their drafts; they were merely given credit for turning drafts in on time. The significant differences between students' approaches in different classrooms suggest that some feature of the structured writing situations themselves may have influenced students' revising practices. Perhaps, by being forced to get started early on their papers, students had enough time to assess and reconsider their approaches.The following excerpts from the process logs of two students who received these structured writing assignments reveal the potential impact of such process requirements.

Lara: Rough Draft. Lara's assigned topic was Biorhythms, and she reported that she began searching for sources in the library two weeks before her preliminary draft was due and nearly 4 weeks before her final paper was due. After completing her draft, Lara explained, "I think I could have done a better job, but I really just wanted to get it over with." Below is an excerpt from the opening of Lara's draft:

> Introduction: What are biorhythms? A biorhythm is defined as the application of mathematics to the biological scheme of things (biomathematics).
> The principle: Nature is ordered, and this order can be investigated using mathematics as a probe or tool to understand and explore human activity.

This passage reveals that Lara did not spend much time adapting or reorganizing source material but instead wrote up information as it appeared in her notes. However, a week later when she began revising this draft, she reports that "after a few attempts at starting the final draft, I finally came up with an idea to make the paper interesting and set it apart from everyone else's." The following opening paragraph from Lara's final paper shows how dramatically she reformulated her approach. She weaves the source material in with her own ideas and uses an extended narrative to explain what she has learned about biorhythms.

> Generic Gerald, an average guy from Pittsburgh, Pennsylvania, is a computer technician for the local IBM plant. Every morning he rises at 6:00 sharp, showers, dresses, and grabs a cup of coffee and a bagel with cream cheese on his way to work. During the course of the day, he works steadily, pacing himself by the digital clock on his desk. . . . As he steps out for his lunch break, he notices Knockout Noreen, his luscious personal secretary, intently studying the latest issue of *Cosmopolitan*. Peeking over her shoulder he sees the headline: "Biorhythms, Superstition or Fact? How to Calculate your Monthly Cycle." Scoffing quite audibly, Generic Gerald

proceeds on his way. Biorhythms? Who ever seriously considered biorhythms?

Shelly: Oral Report. Shelly, who had to give an oral report on Biorhythms, began conducting research three weeks before her paper was due. Throughout her log, Shelly seems most concerned about understanding her topic and finding a focus for her oral report and paper. For example, in one log entry she asked "what do I want to center my paper on?" and then reminded herself that "the assignment says to organize the paper around a point or issue and not to just list facts." On the morning of her in-class presentation, Shelly reported, "I am panicking about having to give an oral presentation in psychology today. Got up early to take some last minutes general notes...My main goal is just to tell what biorhythms are and then to focus on some main points. As of now, the main points I want to focus on are first , how biorhythms develop in humans, and secondly, how they affect the lives of humans or why they are important for us to understand." In the written plans for her oral report, reproduced below, Shelly appears to have adapted source material for her peer audience, organizing it around three key questions.

Oral Report-Biorhythms

1) What are they?
-animals and plants perform certain activities at fairly fixed times of day, month or year.
-annual rhythms, lunar rhythms, circadian rhythms, ultradian (short rhythms ex: heartbeat) sometimes considered the same.
Circadian - period of about a day
ex: bees collecting pollen at certain times of day when the flowers will be open, continue doing this even in the dark.
-leaf movements
-human body temp. is 2 degrees lower at night.
Ultradian - short rhythms like breathing or heartbeat.
Annual - trees flowering and dropping leaves (strongly affected by the seasons but still continues annually).

2) How they develop in humans -gradual; newborn infants are rhythmically disorganized.
-develop regular pattern of sleep after 15 weeks.

3) Why important to understand.
Cause of jet lag - may separate rhythms that resynchronize themselves at different rates.
Medical Importance - more susceptible at night, plan operations accordingly; some diseases desynchronize the rhythms.
Effects on workers - shift changes (sleep patterns)
Agricultural effects - change biological rhythms of plants to fit conditions in an area.
Sleep patterns at college.

When writing her paper a week after giving her oral report, Shelly relied on some of the ideas developed in these plans, reporting, "I took one little concept—the effect of biorhythms in relation to humans and why they are important to be aware of."

A closer look at how individual students defined their research paper assignments reveals that other factors besides process requirements can play a role in shaping students'

approaches. As other researchers point out (Flower & Hayes, 1980; Flower, Stein, Ackerman, Kantz, McCormick & Peck, 1990; Nelson, 1990), the often tacit assumptions and goals that students bring to a writing task can shape their processes and products in important ways. For example, after producing a rough draft of her research paper, Lara explained that her goal in revising was to "look for a unique approach, something to make it stand out from all the other [papers] on the same subject." This high-level goal led to the completely new paper described above, which Lara believed "would be more 'personal' and therefore more interesting to read." Similarly, Shelly returned to the assignment guidelines and struggled to organize her paper around a series of relevant questions.

Beth: Unstructured Writing Assignment. In contrast to Lara's high-level goals and Shelly's questions, Beth—who received an unstructured writing assignment and waited until the day before her paper was due to begin working—described her goals for the research paper this way: "Since it's a research paper, I will barely write anything of my own so it is basically an organization process." Not surprisingly, Beth's limited assumptions about the goals of the research paper shaped her composing processes. She explained, "I didn't write out my rough draft. What I did was footnote the paragraphs out of the book. As you can see from my outline [a portion is reproduced below], I wrote down the color of the book (for easy identification at the computer terminal), the number of the paragraph and where it fits chronologically, and finally the page number it's on in the book."

Mag 1
Mag 3 (no new paragraph)
Light green pg. 208
Beige pg. 73
Dark brown canvas pg. 74
Glossy dark brown pg. 441
Brown canvas pg. 427

Using this outline, Beth produced a 1300 word paper in which 1100 words were direct quotes from her sources. From the start, Beth assumed that the research paper was largely an exercise in assembling and reproducing material, and her color-coded plans and collection of direct quotes reflect this limited task definition.

The descriptions of these three students' approaches suggest why time on task may have played a key role in determining the quality of students' responses. Beth did not actually begin reading or writing about her topic until the night before her paper was due. In contrast, both Shelly and Lara began reading sources and developing plans for their papers over three weeks before their papers were due. If students, like Beth, leave themselves only one night to read, select, and organize information and compose a research paper, they cannot spend much time setting goals, planning, or integrating ideas from sources. Beth received the lowest possible holistic score for her paper (4 points), while Lara and Shelly both received relatively high scores (12 out of a possible 16 points). Interestingly, both Lara and Shelly wrote their papers under classroom conditions which forced them to get started early on their papers. The unstructured assignment in Beth's class allowed her to put off working on her paper until the last possible moment, but her limited assumptions about the goals of the research paper clearly had an impact on her approaches as well.

CONCLUSIONS

The findings of this observational study reveal that when we embed process research in actual classrooms over extended periods of time, we get a richer picture of students' abilities and the forces that shape their approaches. This study also underscores the value of naturalistic research, in particular the value of using the process log as a research tool for examining how a fairly large number of students working on a typical college writing task approach their assignments. Apparently, when the quantity and complexity of information to be included in long papers make such processes worthwhile, some students engage in extensive notetaking and planning. And, when the situation encourages them to, students can use drafting and revision to improve their writing. These findings run counter to those of controlled studies of students' composing processes and provide a much more complex picture of the roles that planning, goal-setting, drafting, and revising may play in students' natural approaches.

The benefits of using these high-investment processes appear to be two-fold. First, students who invested more time in their research papers and created extensive notes and written plans produced higher quality papers. Moreover, most of the the students who made substantive revisions between drafts improved their papers as well. While teachers and textbooks espouse the value of planning, drafting, and revising, there has been little evidence to show that these processes are actually related to paper quality. The findings of this study are encouraging because they reveal a strong relationship between these high-investment processes and paper quality.

In addition to improved paper quality, there may be less tangible but equally important benefits from engaging in these processes in terms of student learning. Students are often expected to research and write about topics that are new to them. By relying on notetaking, planning, and drafting, students are able to use reading and writing in a number of diverse ways to explore and understand a topic—perhaps more fully than students who fail to use these processes (McGinley & Tierney, 1989). Students who know more about a topic before they begin to write are more likely to move beyond rote reproduction of information and to produce higher quality papers (Langer, 1984).

Given these possible benefits, how can teachers encourage students to engage in these processes? The findings of this study suggest two equally important approaches. First, teachers can structure assignments so that students must research their topics and present what they have learned in the form of drafts or talks well before their final papers are due. The process requirements in Lara's and Shelly's classes encouraged them to begin researching their topics three to four weeks before their final papers were due. They used this time to read and accumulate material from sources, to create plans and develop goals for presenting this information to others, and to examine and reformulate their approaches.

But what about students like Beth, whose limited assumptions about the goals of the research paper led to the last minute plundering of sources and rote reproduction of other authors' ideas? She seemed to assume that the aim of the research paper assignment was to test her ability to assemble and reproduce information. Apparently, this assumption is a common one. Schwegler and Shamoon (1982) interviewed college students about why they wrote research papers and received very similar explanations. They found that students view the research paper as "informative in aim," and as an "exercise in information gathering" designed for an audience who already knows about the subject (p. 820). Students operating under these limited assumptions would have no need to rely on extensive planning, goal-setting, or drafting. And, as Clare, the astute student quoted at the beginning of this study points out, sometimes it may be more cost-effective to rely on

stream-lined processes, especially given the limited demands of many school writing assignments which actually reward students for reproducing information (Applebee, 1981; Nelson, 1990).

But students like Beth may not realize that there are other reasons for conducting research and other paths available for writing research papers than the one she chose. Researchers have found that the legacy of previous school writing experiences can have a powerful and sometimes negative impact on students' approaches (Flower, Stein, Ackerman, Kantz, McCormick & Peck, 1990; Nelson, 1990). Beth's conclusion that "since it's a research paper, I will barely write anything of my own" led to a finished paper that earned her a low grade and could have led to accusations of plagiarism. It appears that if students rely on tacit, unexamined assumptions about the goals of writing assignments, they may unwittingly set themselves up for failure. Teachers need to make students aware of the powerful role that task interpretation plays in writing, and to help them to examine and revise their interpretations of common academic writing assignments like the research paper.

Students' interpretations of assignments appear to evolve over time (Flower, 1987; Nelson, 1990). As they conduct research and gain more topic knowledge, students develop and refine their goals for writing. Lara's goal to make her paper interesting and to find an approach that would "set it apart from everyone else's" appeared after she had written a dry summary of her research findings. Shelly's struggle to find a focus for her paper stretched over three weeks, as she planned her oral report and continued to read sources and take notes.

For these students, writing a research paper is a complex constructive act, one that requires them to acquire and transform knowledge to meet a continuously evolving set of goals. As teachers and researchers, we need to continue to find ways to help students to build rich interpretations of such common writing assignments, and to use reading and writing as tools for critical inquiry and learning.

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